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STANDARDIZED RESCUE TRAINING AS PART OF AN EXERCISE PROGRAM FOR KNEE OSTEOARTHRITIS: PROOF OF CONCEPT

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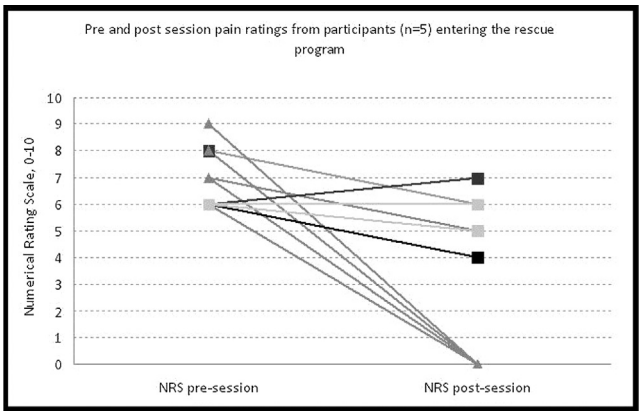
Purpose: Exercise is recommended as one of the primary treatments for patients with knee Osteoarthritis (OA) with known effects on knee pain, mobility, and function. Knee OA pain fluctuates and therefore previously published exercise programs suggest avoiding exercises if excessive knee pain is present. However, applying an exercise program that includes a standardized rescue program would allow the patients to attend an exercise session despite excess pain, and such approach could reduce the current pain intensity because general pain reduction is a known effect of exercise. Although there is a wealth of studies investigating the effectiveness of exercise in patients with knee OA, no such standardised rescue program has been described previously. The aim of this study was to asses if participants referred to a rescue program due to excessive pre-session pain would experience a decrease in pain after rescue exercise.
Methods: We used data from a randomized trial of exercise therapy versus no attention (clinicaltrials.gov: NCT01545258). 31 participants were allocated to the exercise program in the underlying study. These participants exercised for approximately 1 hour 3 times per week for 12 weeks (i.e. 36 possible sessions) supervised by a trained physical therapist. Pre and post exercise pain was recorded using a numeric rating scale (NRS, from 0=no pain to 10=excruciating pain).
The standardized exercise program consisted of 6 focus areas; core strength and control, hip stability, hip abductor strength, knee stability, quadriceps strengthening, and functional training applying the basic exercises into functional tasks. A rescue program was applied if the participant scored a pre-session knee pain of 5 NRS or higher. The rescue program was similar to the full program but excluded weight bearing activities and consisted of 15 minutes warm-up on an ergometer bike followed by 3 exercises: core stability, hip stability and hip strengthening. The 3 exercises were repeated after 5 minutes of cycling.
Results: Of the 31 participants, 5 (16%) was referred to the rescue program between 2 and 8 times during the 12 week period; 2 were referred twice, 2 were referred four times, and 1 was referred eight times. The maximum number of consecutive rescue sessions was 3 times for one participant. In 15 rescue sessions (75%) the participants experienced a decrease in pain. On 4 occasions (20%) the participants experienced no change in pain intensity, and at 1 occasion (5%) a participant experienced an increase in pain intensity (from 6 NRS to 7 NRS). The mean pre-rescue pain intensity was 6.7 (min: 6; max: 9), and the mean post-rescue pain intensity was 3.9 (min: 0; max: 7). The average decrease in pain following a rescue session was 2.9 (min: -1; max: 9). Individual pre- and post rescue session pain ratings are shown in figure 1.
Conclusion: Implementing a standardized rescue program is effective in terms of reducing pain intensity in case of excessive pre-session pain. We believe that the rescue program gives the participants a positive exercise experience despite having knee pain that would make conventional exercise unsafe. It is our belief that a rescue program helps increase adherence to an exercise program and hopefully translates into better self-administered exercise routines and habits.



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SIGNIFICANCE OF PRE-RADIOGRAPHIC MRI LESIONS IN PERSONS AT HIGHER RISK FOR KNEE OSTEOARTHRITIS

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Purpose: The clinical significance of pre-radiographic MRI lesions in persons at risk for knee osteoarthritis (OA) is unclear. Understanding whether such lesions are inconsequential or early disease will aid prevention and disease-modifying strategy design. Our objectives were

Table 1
Pre-radiographic MRI Lesions at the 12-Month Visit and Risk of Incident Persistent Knee Symptoms by the 60-Month Visit (n = 573 knees without frequent knee symptoms at baseline from 573 persons with both knees K/L 0). The table shows the frequency of knees with incident persistent knee symptoms among knees without and with each lesion and the lesion present vs. absent adjusted odds ratio (OR) and associated 95% confidence interval (CI) for incident persistent knee symptoms. Significant results are shown in bold italics. (TF = tibiofemoral; PF = patellofemoral)

	Number of knees (1 knee per person)	Number of knees (row%) with incident persistent knee symptoms	OR [95% CI) Adjusted for age, gender, BMI, previous knee Injury, previous knee surgery
Cartilage damage, TF or PF or both*	419	84 (20.1%)	1.73 (0.98, 3 03)‡
Cartilage damage TF only*	83	12 (14.5%)	1.18 (0.51, 2.74)‡
Cartilage damage, RF only*	176	37 (21.0%)	***1.98 (1.05, 3.76)***‡
Cartilage damage, both TF and PF*	160	35 (21.9%)	***2.00 (1.04, 3.85)***
No carriage damage (TF or PF)	154	18 (11.7%)	*reference*
Bane marrow lesion, TF or PF or both†	334	73 (21.9%)	***1.90 (1.18, 3.06)***‡
Bane marrow lesion, TF only†	47	8 (17.0%)	1.42 (0.59 3.45)§
Bone marrow lesion, PF only†	195	42 (21.5%)	*1.82* ***(1.07,*** *3.09)*
Bone marrow lesion both TF and PF†	92	23 (25.0%)	***2.31 (1.24, 4.32)***
No bone marrow lesion (TF or PF)	239	29 (12.1%)	*reference*
Meniscal HHr‖,¶	108	29 (29.6%)	***1.83 (1.05, 3.19)***‡
No meniscal tear	465	73 (15.7%)	*reference*
Meniscal extrusion¶	60	17 (28.3%)	1.34 (0.68, 2.62)‡
No meniscal extrusion	513	85 (16.6%)	*reference*

*Each cartilage damage pattern was evaluated in a separate model in which no cartilage damage in either TF or PF compartment was the reference group.
†Each bone marrow lesion pattern was evaluated in a separate model in which no bone marrow lesion in either TF or PF compartment was the reference group.
‡BMI also significant.
§Previous surgery also significant.
‖Of the 108 meniscal tears, 80 were horizontal tears. 11 were vertical, 4 were complex, and 13 menisci were partially macerated.
¶To adjust for the presence of the other meniscal lesion, meniscal tear and meniscal extrusion were included in the same model.

Table 2
Pre-Radiographic Lesions at the 12-Month Visit and 12-to-48 Month Incident TF Cartilage Damage (upper portion of table) and 12-to-48 Month Incident PF Cartilage Damage (lower portion of table). The table shows the frequency of knees with incident cartilage damage among knees without and with each lesion and the lesion present vs. absent adjusted odds ratio (OR) and associated 95% confidence interval (CI) for incident TF cartilage damage. Significant results are shown in bold italics. (TF = tibiofemoral; PF = patellofemoral)

	Number of knees without TF cartilage damage at the 12- month visit (457 knees from 457 persons with both knees K/L 0)	Number of knees (row%) with incident TF cartilage damage	OR (95% CI) adjusted for age, gender, BMI, previous knee injury, previous knee surgery, hand OA, physical activity
Bone marrow lesion, TF or PF or both *No bone marrow lesion (TF or PF)*	234	30 (12.8%)	1.83 (0.94, 3,57)*
	223	15 (6.7%)	*reference*
Bone marrow lesion, any TF *No TF bone marrow lesion*	64	8 (12.5%)	1.38 (0.60, 3.17)†
	393	37 (9.4%)	*reference*
Meniseal tear§,‖ *No meniscal tear*	56	6 (10.7%)	1.05 (0.39, 2.82)‡
	401	39 (9.7%)	*reference*
Meniscal extrusion§ *No meniscal extrusion*	37	6 (16.2%)	1.72 (0.63, 4.71)‡
	420	39 (9.3%)	*reference*
	Number of knees without PF cartilage damage at the 12- month visit (322 knees from 322 persons with both knees K/L 0)	Number of knees (row%) with incident PF cartilage damage	OR (95% CI) adjusted for age, gender, BMI, previous knee injury, previous knee surgery, hand OA, physical activity
Bone marrow lesion, TF or PF or both *No bone marrow lesion (TF or PF)*	94	18 (19.2%)	***2.68 (1.32, 543)***
	228	19 (8,3%)	*reference*
Bone marrow lesion, any PF *No PF bone marrow lesion*	52	14 (26.9%)	***4.26 (1.97, 9.22)***
	270	23 (8.5%)	*reference*

*hand OA also significant in this model, adjusted OR ***2.07 (1.02, 4.19)***.
†hand OA also significant in this model, adjusted OR ***2.09 (1.04, 4.20)***.
‡hand OA also significant in this mode), adjusted OR ***2.03 (1.004, 4.10)***.
§To adjust for the presence of the other meniscal lesion, meniscal tear and meniscal extrusion were included in the same model.
‖Of the 56 meniscal tears, 43 were horizontal tears, 8 were vertical, 1 was complex, and 4 menisci were partially macerated.

to determine extent of tissue pathology by MRI and evaluate its significance by testing the hypotheses: cartilage damage, bone marrow lesions, and meniscal damage are associated with incident persistent symptoms; bone marrow lesions and meniscal damage are associated with incident tibiofemoral cartilage damage; bone marrow lesions are associated with incident patellofemoral cartilage damage.
Methods: In a cohort study of 849 OAI (Osteoarthritis Initiative) participants who were Kellgren and Lawrence grade 0 in both knees, we assessed right knee (left if right technically inadequate) cartilage, bone marrow lesions, and meniscal damage on 12-month MRIs using MOAKS, as well as, in those at risk for each outcome, incident persistent symptoms (frequent knee symptoms or medication use for knee symptoms most days of a month in the past 12 months, at 2 consecutive annual OAI visits) by 5-year follow-up, and incident tibiofemoral cartilage damage and incident patellofemoral cartilage damage by 4-year follow-up. Multiple logistic regression (one knee/person) was used to evaluate associations between MRI lesions and each of these outcomes, adjusting for age, gender, BMI, knee injury, and knee surgery, (and, in cartilage damage models, further adjusting for hand OA and physical activity).
Results: 76% had cartilage damage, 61% had bone marrow lesions, 21% meniscal tears, and 14% meniscal extrusion. As shown in Table 1, in 573 knees (from 573 persons) at risk, cartilage damage (isolated patellofemoral; tibiofemoral and patellofemoral), bone marrow lesions (any; isolated patellofemoral; tibiofemoral and patellofemoral), meniscal tears, and BMI were associated with incident persistent symptoms. As shown in Table 2, in 457 knees at risk, hand OA but no individual lesion type was associated with incident tibiofemoral cartilage damage, and, in 322 knees at risk, bone marrow lesions (any; any patellofemoral) with incident patellofemoral damage. Having more lesion types was associated with a greater risk of outcomes.
Conclusions: In persons at higher risk but without any evidence of radiographic knee OA, cartilage damage, bone marrow lesions, and meniscal tears were associated with the new development of persistent symptoms, and bone marrow lesions with the new development of patellofemoral cartilage damage. These findings suggest that these lesions are not incidental in persons at higher risk and may represent early disease and illness.

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PREVENTION OF KNEE OSTEOARTHRITIS IN OVERWEIGHT FEMALES; EFFECT ON PROGRESSION OF MRI FEATURES AND KNEE PAIN

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Purpose: The preventive effect of a diet & exercise program and of oral glucosamine sulphate on the primary outcome 'clinical and radiographic knee osteoarthritis (OA)' in the PROOF study was borderline significant. Is it unknown what the effect is on the more sensitive secondary outcome 'progression of OA-features on magnetic resonance imaging (MRI)' and if such outcome is related with incident chronic knee pain. The aim of this study is to evaluate the preventive effects of the PROOF study on progression of MRI OA-features and to evaluate the association between progression of MRI OA-features and incident chronic knee pain.
Methods: In a 2x2 factorial design, the effects of a diet and exercise program (DEP) versus no intervention (DEP control) and of double-blind glucosamine sulphate (GS) versus placebo on the progression of MRI OA-features, were evaluated over 2.5 years in a high-risk group of 407 middle-aged women with a BMI $\geq$ 27 kg/m 2 and without knee OA during initial screening (PROOF study, ISRCTN 2823086). MRIs were scored using the MRI Osteoarthritis Knee Score (MOAKS). Progression of MRI OA-features was defined as progression of bone marrow lesions, cartilage loss, osteophytes or meniscus pathology (extrusion and morphologic change). Intention To Treat (ITT) and Per Protocol (PP) analysis for those compliant to DEP were performed on knee level using adjusted Generalized Estimating Equations. The same statistical model was used for the analysis between progression of MRI OA-features and incident chronic knee pain, defined as pain in the last 12 months and on most days of the previous month. Due to a known interaction between the two interventions (DEP and GS) on the primary outcome, the 3